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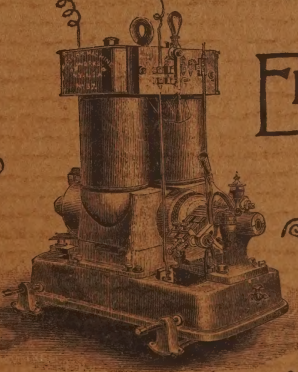
ISED EDITION, 1887.

# STREET LIGHTING BY THE EDISON MUNICIPAL SYSTEM.



THE EDISON ELECTRIC LIGHT CO.

Address
No. 16 Broad St.
New York.

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THE

# EDISON SYSTEM

OF

# MUNICIPAL LIGHTING,

AS APPLIED TO THE

## ILLUMINATION

OF

## STREETS, AVENUES, PARKS AND PUBLIC SPACES.

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NEW YORK:
BURGOYNE'S QUICK PRINT, 146-150 CENTRE STREET.
1887.

# EDISON ELECTRIC LIGHT CO.

16 BROAD STREET, NEW YORK.

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# THE EDISON MUNICIPAL SYSTEM.

Few of all the methods proposed by Mr. Edison for adapting the incandescent lamp to a wide-spread commercial use, have attracted the attention among electrical people which was at once accorded to the Municipal System. It was instantly recognized as an almost invaluable adjunct to the three-wire plan, greatly enlarging the possible business of a central station in a very profitable direction.

During the past year much interest in the subject of street lighting has been developed by our local companies.

## GAS, NAPHTHA AND KEROSENE.

According to existing conditions and circumstances governing cost, it is found that the average price paid by municipalities ranges from $12 to $40 for each gas lamp per year. The candle power of these gas lamps ranges from 8 to 24 candles.

Naphtha and kerosene lamps run as low as 6 candles each. These candle powers exist when the lights are burning under favorable conditions, but it is usual for the *lanterns* to be *dirty*, the *chimneys smoky*, and the flame affected by the wind, so that only about *half the benefit* is actually derived from the light that the corporation pays for.

Even in the cleanest and clearest lantern at least 12 per cent. of the light is absorbed in passing through the glass.

## COMPETITION WITH GAS.

Edison local companies have been and are now securing contracts for street lighting, not only successfully competing with gas companies *in price*, but supplying a better light for the streets at very much lower prices than gas companies have been receiving, and still at a handsome profit to themselves. In several cities, where the streets have been lighted with gas, our local companies have *underbid the gas companies*, thereby securing very profitable contracts. In New York City gas lamps in the streets have been supplied at the rate of $21 per lamp-post per annum, while the arc light companies have been receiving at the rate of 70 cents *per night* for each arc lamp; and it has been estimated that, with the arc lamps of 500-candle power only about 50 feet further apart than gas lamps of eight-candle power, the arc light service has cost the city nearly five times as much as gas.

The public lighting of New York City, from the "City Record," Feb. 26, 1886.

### PUBLIC LAMPS.

At the close of the year there were 23,555 gas-lamps, 708 electric-lights and 50 naphtha-lamps in use on the streets, parks, docks and bridges in the city. 813 new gas-lamps, 61 electric-lights and 50 naphtha-lamps were erected during the year. The total length of streets lighted by public lamps is 455 miles, of which 12½ miles were provided with lamps during the year. The City also provides light for 38 acres of public parks, 1¼ miles of piers and docks, and 1⅜ miles of bridges. Twenty-four miles of additional gas-mains were laid during the year by the several gas companies, making a total of 977⅜ miles of gas-mains now under the streets of the city.

*Exterior electric illumination* has heretofore not been of a comprehensive character, in that it has only been applied to main thoroughfares and prominent open spaces, leaving the suburbs and less prominent parts to be served by the old methods of gas and oil lamps.

## ARC LIGHTS.

Arc lights have been adopted in many cities and towns where the unsatisfactory results of gas or vapor burners have created a positive demand for some better mode of illumination. The question of their efficiency or wastefulness has been and is being discussed by almost every arc light company in the country. The first trials of their power were made on short street posts, and when these were shown to be unsatisfactory, the attention of experimenters sprang at a bound to the other extreme of towers so lofty, as to waste their energy still more hopelessly in a vain attempt to light an entire city from one or a few centres.

Scattered points of great intensity are often productive of confusing and blinding effects. The most powerful lamps on the top of 50-foot poles, in a city of heavy shade trees, would, during more than half the year, simply light the foliage, and show as moonlight, very much clouded, on the walks and drives below.

It must not be forgotten that the power of the arc lamp is also greatly overstated in common estimates. A "2,000-candle lamp," requiring from 0.7 to 1.25 horse power in different systems, furnishes about 800 to 900 candles, and a "1,200-candle lamp" from 300 to 500 candles. The bluish-white arc also possesses less penetrating, and less diffusive power for street uses, than the rays of the Edison lamp. If, therefore, the one-horse power necessary for the average arc lamp be broken up into four units of 32-candle power, or eight units of 16-candle power each, and distributed over the same area, a more uniform and often more satisfactory general result will be secured. It is not necessarily the most intense illumination which proves most serviceable, or even most gratifying to the eye.

This view is clearly and concisely stated in the following extract from report to the Honorable Commissioner of

Streets and Sewers of the City of London, England, by Wm. Haywood, Engineer and Surveyor :

* * * * * * *

"The illuminating powers of the electric lamps, according to the statements made by the various contractors, appear to be very much higher than that of the ordinary gas lamps which they displaced. But there are differences of opinion as to the mode that should be adopted for estimating the strength of these lights; the large powers assigned to them generally by electricians, have been considered by many who are skilled in these considerations, to be in excess of their true illuminating power.

Without either admitting or denying the correctness of the statements made to me, I may observe that it was obvious to any one walking through the city thoroughfares, and accustomed to seeing those thoroughfares when lighted by gas, that there was a larger amount of light given by the electric lamps compared with that given by the ordinary gas lamps; nevertheless, owing to the distances apart of the electric lamps, and the *height* also at which some of them were placed, the *vast excess of light* claimed for them by the contractors was not so evident as might have been expected.

The value of the excess of light to the commission, whatever it really might have been, must be determined by practical considerations. *For public thoroughfares, uniform distribution of light, generally speaking, best meets the public requirements, and this can be most successfully obtained by many small lights at small distances apart. Powerful centres of light at long intervals apart* give intense brightness with deep shadows in their immediate vicinity, and distribute the light very unequally over the areas assigned to them; *tested by this principle the* excess of *light given by the electric lamps* was much less *valuable than might be* supposed."

The "Intelligencer," of Lancaster, Penn., in an editorial article commenting on different systems of lighting the streets, closes as follows :

"The system, however, which *divides* the light and enables it to be put at *frequent intervals* along the street, seems to be much the best for street lighting. We do not need an extensive illumination at street corners, and a light which blinds those approaching it, while leaving in darkness the middle parts of the squares. We want every part of the street to be equally lighted; and this can only be done by dividing the light and putting the lamps a short distance apart."

We may therefore sum up in a single sentence :

*The fundamental principle of all artificial lighting whether interior or exterior is an even distribution* of light, such as can only be obtained by placing lights of *moderate candle power* at *frequent intervals.*

This law, whether recognized or not, is as inexorable as the law of gravitation, and when a standard of lighting has once been established by the placing of a few powerful centres, the eye demands an even distribution on this high standard, and consequently a large number of lamps and corresponding outlay of money. Hence there are to-day comparatively few cities where satisfactory results have been attained by the use of the arc light in streets, when judged from the standard of uniform distribution and low cost.

There can, however, be no doubt that a demand has been created by the use of the arc system, for more light in the prominent streets, parks and squares, than can be economically furnished by gas jets. When this demand is decided and arc lights can be sold at a profitable figure, it is the part of wisdom for an Edison Company to control and operate them instead of allowing a separate organization to exist in competition with their work.

In many cases public sentiment calls for a combination of large and small lights; in others, a well arranged system of small candle-power lamps will prove equally or more gratifying.

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## MR. EDISON'S IDEAL NOW COMPLETE.

Mr. Edison once said: "What I set out to do was to supply a light which would displace gas, wherever that could be successfully used."

Until the invention of the "municipal" system, Mr. Edison had not fully accomplished his purpose. Its easy adaptability to that portion of the lighting of a city or town which is controlled by the municipal authorities, and which is necessarily too much scattered to bring such lighting within easy reach of the domestic system, finally provides

within the "EDISON SYSTEM OF ELECTRIC LIGHTING" the best and most perfectly adapted method of doing every kind of artificial illumination whether public or private. Hence Mr. Edison's work is now absolutely complete.

The municipal system has been designed to work in harmony with the domestic system, so as to obtain the *highest* economy of operation and the minimum of investment in each.

Hence, by the combined use of all these methods,

**EDISON COMPANIES CAN NOW SWEEP THE FIELD.**

Whatever the necessity, an Edison illuminating company may now fearlessly attack the problem, assured not only of a scientifically accurate, but a commercially economical solution.

Street lighting contracts are very profitable to illuminating companies doing a general commercial business, because they furnish a source of revenue during hours when stations would otherwise be running their minimum load.

The cost of production is only felt in coal, water, oil and lamp breakage, while other items remain the same as before, consequently the profits are proportionately larger.

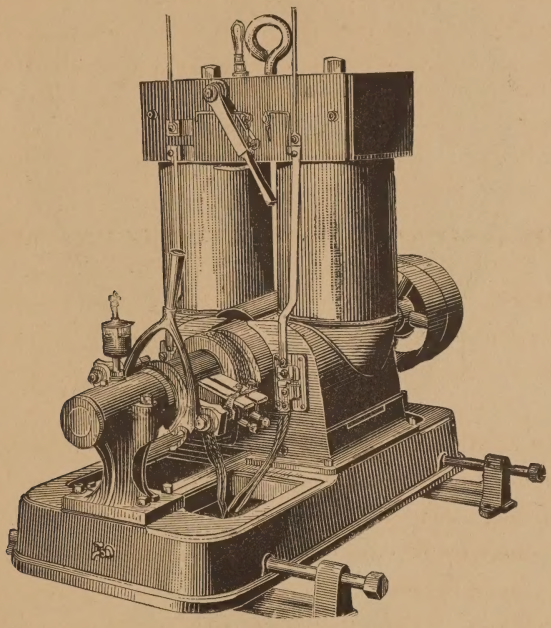
There are four points which will specially interest our representatives:

**1. THE PECULIAR FEATURES OF THE MUNICIPAL SYSTEM.**

The dynamo first constructed for this purpose gives 1,000 volts, and is made in two sizes, 12 and 30 amperes. Several of the larger type are in use in the present stations.

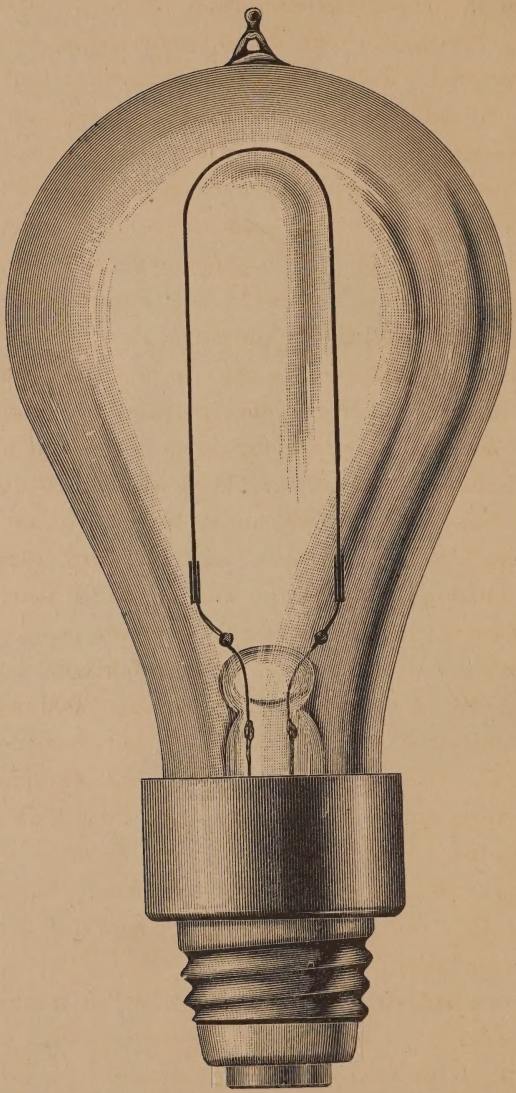
The future dynamo will give a maximum E. M. F. of 1,200 volts, which allows for any drop in potential which may be desirable up to 17 per cent. in the wire, while a pressure of

1,000 volts is left to be expended in the lamps. Three types have already been estimated upon. The figures respecting these new machines, which will be of especial interest, are here given.



**The Municipal Dynamo.**

| Dynamo Type | A. | B. | C. |
|---|---|---|---|
| Number of Circuits | 4 | 8 | 12 |
| 15 C. P. Lamps | 265 | 530 | 800 |
| 20 " " | 200 | 400 | 600 |
| 25 " " | 160 | 320 | 480 |
| 30 " " | 135 | 270 | 400 |
| 40 " " | 100 | 200 | 300 |
| 50 " " | 80 | 160 | 240 |
| Diameter of Pulley | 13 | 17 | 24 |
| Revolutions | 1,300 | 1,000 | 700 |
| Width of Belt | 9 | 11 | 12 |
| Floor space | 69 x 51 | 85 x 62 | 94 x 70 |
| Shipping weight | 4,000 | 7,820 | 14,000 |



**The Municipal Lamp.**

The lamp is of low resistance, with thick substantial carbon, the length of the loop determining the candle-power and the E. M. F. required. Hence, as a 15-candle lamp has

a carbon of the same cross-section as one of 50 candles, it requires the same current, the difference being simply in the volts absorbed. This gives a remarkable flexibility to the system, the only requisite in calculation being that the total candle power in each of the various circuits shall conform approximately to a given standard, which standard is found by a determination of the most economical percentage of loss in the conductor in each particular instance.

The lamps thus far used have required about three amperes, and have been of the same standard of efficiency as the high resistance lamps used in the three-wire system. Their life has been very long, reaching in multitudes of cases from 1,500 to 3,000 hours, with only slight blackening of the bulb before breaking. The standard of distribution for this lamp has been 640 candles for each circuit.

A second type will also be made hereafter, allowing of a greater number on a wire, the current being four amperes, an increase of one-third, while the pressure per lamp is reduced somewhat in excess of that proportion, thus raising the standard of efficiency, and securing 1,000 candles on each circuit of 1,000 volts. This effects a considerable reduction in cost of conductors and station appliances in a large system, and also reduces the percentage of change in current when a lamp breaks.

We have arranged a complete equipment of standard appliances, blue prints of which will be supplied to agents or constructors at any time.

The standard street hood adopted for the Municipal, after a great number of experiments, has a metallic frame and top, with an inverted conical reflector of opal glass, which " lights up " in a very efficient manner. It contains a socket and cutout of exceedingly simple construction, which, in case the safety device in the lamp itself should fail, operates to complete a shunt around the terminals, and also to maintain the continuity of the circuit when a lamp is removed,

either intentionally or by accident. The method of readjustment when a new lamp is placed is such as to compel an inspection of the mechanism to insure continued reliability.

An ornamental form of hood is made entirely of opal shades, and is admirably adapted to hotel piazzas, railroad approaches, private grounds and other special locations.

An exceedingly important attachment to every municipal hood when suspended from either an iron or wooden post or other support in the open air, is an insulator which makes it impossible for the wires, cross-arm or frame of the hood to become grounded at this point. The standard form contains a hard rubber device which with a metallic coupling in which it is encased makes a "double petticoat" insulator, capable of standing any mechanical strain which may be put upon it in practice.

When used apart from the ordinary street connection, a special socket with non-conducting shell is supplied, which also serves as a perfect cutout for every lamp. A special flexible cord is necessary in using this system which, as a matter of convenience and special precaution against accident, is connected at the ceiling with a simple and ornamental receptacle.

The station apparatus necessary to operate each circuit is placed on a separate base, and a number of these sections, ranged on proper supports, allowing of free access from the rear, form a compact switch-board, preventing liability of leakage, and rendering it easy to connect each circuit with any one of several dynamos.

## 2. WHAT THE MUNICIPAL HAS ALREADY DONE.

There have been eight installations made of this system, as follows:

| | Number of Lamps. | Candle Power. | District Lighted. |
|---|---|---|---|
| Lockport, N. Y | 75 | 16 & 32 | Outskirts of City. |
| Portland, Me. | 500 | 10, 16 & 32 | 4 miles in length. |
| Lawrence, Mass. | 550 | 10 & 16 | Entire City. |
| Jacksonville, Fla. | 150 | 10 & 16 | 1 mile from Station. |
| Denver, Col. | 530 | 20 | Through the City. |
| Lachine Canal | 160 | 50 | 4 miles long. |
| Seattle, W. T. | 160 | 16 | Streets. |
| Tacoma, W. T. | 180 | 20 | Streets. |

The first trial of the system was made early in 1885 at Lockport, N. Y. Here the gas company desired to light streets in the suburbs beyond the reach of their mains and have found a feasible means in the Municipal.

In Portland, Me., 280 incandescent lamps are run on twelve circuits through heavily shaded and narrow streets, alleys and suburban districts, in conjunction with 150 arc lights in the larger spaces. The fact that under these circumstances the incandescent has since its starting, October 1, 1885, demonstrated its fitness for well-diffused lighting, is strong evidence of its future popularity. The remaining lamps are doing good service in printing offices, where a constant load makes their use very economical, and in the audience room of the City Hall, which seats 3,000 people. Some of the street circuits are five miles long.

A similar use has been made since January last of the system in Jacksonville, where it was purchased by the Gas Company, and an increase is now being installed, giving an additional capacity of 150 20-candle lamps. The entire plant is devoted to store lighting, the circuits being controlled entirely from the station.

Lawrence, Mass., has a considerable number of 10-candle lamps, replacing the naphtha formerly in use. Though actually giving more light than the old method, and at a less price, the expectation of the people that a far greater intensity will always result from the introduction of electricity has led to complaints and misrepresentation, which are for the most part wholly unfounded. It is probable that the power of these lamps will be quite generally increased, bringing them to a proper standard for street service.

The Colorado Electric Company of Denver found the Municipal system a valuable addition to their street lighting facilities, and have followed the example of Portland, sprinkling 20-candle lamps among the more costly arcs. A most determined effort has been made to belittle the results, yet, in spite of defects in some of the earlier forms of devices, the light is now well spoken of, and has become one of the institutions of this enterprising Rocky Mountain city.

An interesting application of this wonderfully flexible system is shown on the banks of the Lachine Canal in Canada, where 50-candle lamps are placed one hundred and thirty feet apart. The "Montreal Gazette" says:

> "The basins have been a dangerous spot for want of good light on dark nights, and now the Lachine Canal and basins will compare favorably with anything of the kind on the continent."

Seattle, Washington Territory, has for a few months tried a small plant, with the result of an increase now going in, raising the capacity to upwards of six hundred lamps.

A system of about 100 street and 50 interior lamps is about ready to start in Tacoma, W. T.

It will be seen that this system has already been applied to a variety of conditions, and its details have been worked out so that it is reliable and satisfactory. The prices secured

in these cities are as low, or lower, than those of the gas which has been displaced, and the greater elevation of the lamp gives a considerable advantage.

### 3. WHAT IT CAN DO.

The Municipal System has been specially devised for street lighting and enables the Edison light to be distributed over large areas, by the use of single lines of small wire.

It can light groups of several small towns or suburban districts from one station.

It can be used with the greatest facility in mines and caves.

It is particularly adapted for uniformly and economically lighting railroad yards, platforms, stations, tunnels and bridges.

We do not recommend it for interior lighting. The high pressure makes the current difficult to control and dangerous in the hands of inexperienced persons. The lamps are not separately controllable, and the circuits must be lighted and extinguished at the station.

### 4. THE BEST METHOD OF EXPLOIT.

Demonstrate the serviceability of the system by small contracts in suburban districts or towns not reached by gas mains.

To secure satisfaction, the candle power of the electric lamp should always be superior to the gas or naphtha which it displaces. Electric light always means *more* light. Nothing less than 15-candle power lamps are suitable for narrow courts and alleys, and excepting in such cases we shall discourage the use of anything smaller than 20 candles.

Note especially the following points as to estimates. The widely varying conditions existing in different places in area

to be covered by street lighting system ; lamps required per square mile of this area ; trees and other obstacles to pole lines ; the proper size of conductors as affected by the price of coal, &c., all place it beyond our ability in the present early stage of this branch of the business to formulate any rules for reliable estimates on the cost of installation or expenses of operating. Agents should therefore send to this office in each case replies to the following questions, in response to which estimates will be forwarded showing the modification of our plan of running circuits, the type of lamp, and the patterns of pole and station apparatus which are best adapted to the particular instance :

1. What conditions are imposed by the city or the State law in granting a right of way? Please send copy of ordinance or vote under which you act.

2. What privileges can you secure (in writing) as to using poles of other people, and how far will it be desirable to do this?

3. Send a tracing or sketch, drawn to scale, showing location of lights to be displaced (designating gas, naphtha or other lights, by separate symbols) ; kind and locations of trees which will prove obstacles to pole work ; location and approximate height of poles of other companies (using some sign for such as are suitable to support Municipal wires) ; kinds of sidewalk in the proposed district, and location of station.

4. Kind of coal available for boilers ; cost delivered in station.

5. Location, extent and cost of any other feasible power (a water power at a considerable distance may sometimes be made economical).

6. Size and kind of poles most desirable, and cost delivered at the holes.

7. Present prices of gas or naphtha per post (annual); candle power of each, and hours burned per year. Specify also expense of repairs, lighting and extinguishing, also power of any other lights used and prices paid.

8. Probable future increase of the business.

These statistics will not only be valuable to us in arranging for estimates and construction, but will become a part of the permanent records of the office, and prove serviceable in the future of the business.

**A BRIEF REVIEW OF THE ADVANTAGES OF THE EDISON MUNICIPAL SYSTEM AND OF STREET LIGHTING TO EDISON CENTRAL STATION COMPANIES:**

A clean, clear, steady, brilliant light.

---

Lamps of various degrees of candle-power on the same circuit to meet the varying requirements of locality.

---

Reduced cost of daily attendance in cleaning and repairing, lighting and extinguishing of lamps.

---

The ability to successfully compete with gas companies in every class of lighting in which they engage.

---

The ability to cover all streets, alleys and suburbs at the minimum cost of installation for long distances from station.

---

The profit derived from constant loads and long hours.

---

Instantaneous notice at the station when a lamp breaks.

---

Immediate lighting of certain districts in case of alarm of fire.

## THE MUNICIPAL STREET LAMP.

Cannot be blown out.

Does not flicker in a high wind.

Makes it possible to light an entire city instantly.

Needs no outside lantern for protection, thus reducing cost of cleaning.

Indicates at the station, when its carbon breaks, a change in the resistance of the circuit.

Being controlled from the station, makes it possible to dispense entirely with the lighters.

Enables an arc light company to cover the narrow streets, alleys and shaded districts, and the distant suburbs which gas has never reached.

Enables a gas company to cover with a flexible and easily-controlled system outlying districts which cannot profitably be covered with their mains.

Is supported from the top and hangs downward, thus casting no shadows where they are objectionable, and making all its illuminating power available.

Requires generally very light pole lines, and only one wire on a street; is brilliant, constant, free from sputtering, and requires attention only when its life is finally ended.

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## INTERESTING NOTES.

Lamps of greater or less candle-power can be run on the same circuit as may be required by the different localities in which they are placed.

Estimates of operating expenses should include $5 per post for annual outlay for inspection of circuits, replacing of lamps, cleaning hoods, repainting, &c.

It is imperative that all the devices, supports and wire used in the building of Municipal lines be of such kind and

quality as to afford the most complete insulation possible. These precautions being observed, it is found to be perfectly feasible to run a large number of lines from one dynamo having a constant high pressure.

This system permits the use of Edison Incandescent Lamps in series, on long stretches of small wire, which is impracticable in connection with the ordinary multiple arc system, and therefore the cost of copper in long distance conductors is reduced to a minimum, and the necessity for the heavy copper conductors of the domestic system is obviated.

It has been decided that as a matter of protection to the reputation of the business, it is necessary that an expert be furnished to superintend the construction of the first plant installed by a new contractor, or a company or agent not practically acquainted with this department of the business. Estimates on the cost of plants should therefore be made with this service in view.

*The current used in this system is of high tension (1,000 volts), which would be unsafe to introduce into dwellings, hotels, stores or buildings of any character, where the wires and sockets are liable to be handled by inexperienced persons, but when they are stretched on poles in the open air, and the lamps are attended to by persons who have been properly trained, all danger to the public ceases.* If desired, the circuits for this system can be laid underground at reasonable cost.

The "Municipal," whether installed as a separate plant or a part of a large system, is treated by this company as central station business, and all correspondence as to prices, specifications, diagrams for installations, and orders for apparatus should be addressed to

W. J. JENKS, *Manager*,
MUNICIPAL DEPARTMENT, EDISON ELECTRIC LIGHT CO.,
Room 53, 16 Broad Street, New York City.

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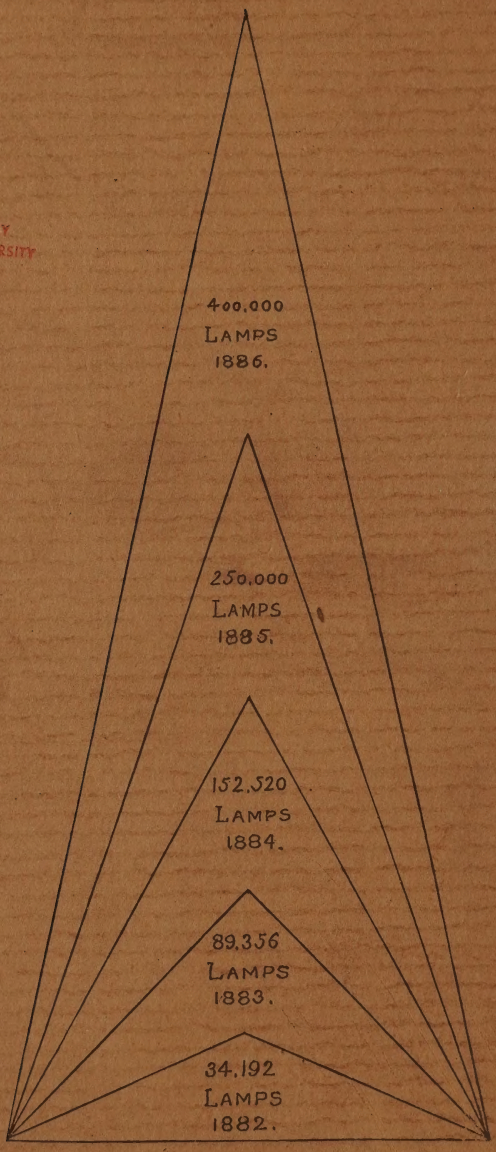


EDISON.